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ABSTRACT

Development of self-conscious emotions such as embarrassment are thought to depend on the emergence of a sense of self as distinct from other. This longitudinal and cross-sectional study sought to replicate the association between a self-referential visual self-recognition task and embarrassment, and to extend the understanding of the interrelations between pronoun production and emergence of "other" in imitative pretend play tasks as indicators of self-development. Toddlers' embarrassment reactions (in response to an over-complimenting experimenter), self-recognition, and complexity in imitative pretend play were assessed in a laboratory setting when subjects were 19, 22, 25, and 28 months of age. Pronoun production was assessed through maternal reports when the subjects were 18 and 24 months old. Participating were 161 toddler twins who were part of an ongoing longitudinal study of emotional development. The cross-sectional sample size ranged from 51 to 64, while longitudinal sample size with listwise deletion across all four time points was 30. The findings provided very limited support for the hypothesis that the acquisition of a distinct sense of self is associated with embarrassment reactions as they were assessed. The findings did strongly suggest that development of complexity in pretend play, self-recognition, and embarrassment run largely parallel to each other, with different rates of change. Relations between pronoun production and embarrassment were mostly mixed: some associations supported and some contradicted the developmental priority of pronoun production as a measure of self-development over embarrassment. (KB)

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Developmental progression of embarrassment and self-development in the second year

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Introduction

Development of self-conscious emotions such as embarrassment are thought to depend on the emergence of a sense of self as distinct from others, often indexed by self-referential behaviors in visual self-recognition tasks, pronoun production, and complexity in pretend play (Lewis, 1995). Evidence from prior work suggests that embarrassment in situations involving self-exposure is more likely to be observed among toddlers who have acquired self-recognition (Lewis et al., 1989). However, we know relatively little about the interrelations between other indicators of an emerging sense of self such as pronoun production and complexity in imitative pretend play and emotions such as embarrassment.

In this report, we sought to replicate the association between self-referential visual self-recognition task and embarrassment, and extend our understanding of the interrelations between two other indicators of a developing sense of self and embarrassment. In addition to acquisition of self-recognition, we examined pronoun production (Lewis, 1995) and emergence of "other" in imitative pretend play tasks (Brownell & Carriger, 1990) as indicators of self-development. We assessed embarrassment reactions in response to an over-complimenting experimenter (coding a combination of coy smiles, face/ body touching and gaze aversion). Embarrassment, self-recognition and complexity in imitative pretend play assessments were carried out at 19, 22, 25 and 28 months in the laboratory, and pronoun production was assessed through maternal reports on the Mac Arthur Communicative Development Inventory at 18 and 24 months of age.

On the basis of Lewis et al.'s previous work (1989) we would expect toddlers who show mark-directed behavior in the mirror-rouge task to also show clear indications of embarrassment in self-exposure situations that are designed to elicit embarrassment. For example, children who acquire self-recognition at either 19 or 22 months of age should be more likely to show embarrassment when over-complimented by a familiar female experimenter. We would also expect children who produce pronouns or show a sense of other in imitative pretend play to be also more likely to be embarrassed. To examine these interrelations, we carried both longitudinal and cross-sectional analyses using a sample of twins. The study of twins provide a unique opportunity to examine the strength of the relationship between self-recognition and embarrassment given that identical twins _due to their physical similarity_ may be delayed in the acquisition of self-recognition relative to fraternal twins and singletons. If the relationship between self-recognition and embarrassment does not hold for samples of twins relative to

singletons then it might be possible to identify alternative pathways to the acquisition of these emotional reactions.

Method

Sample

Data from a total of 161 toddler twins who participate in an ongoing longitudinal study of emotional development from birth to 3 years were used in this report. The toddlers come from primarily middle class families around Madison, WI and are Caucasian. In order to circumvent non-independence of errors, we randomly selected one child from each twin pair to address the questions here. The cross-sectional sample sizes range from 51 to 64, while longitudinal sample sizes with listwise deletion across all four time points is 30.

Procedure

The toddlers were observed at 19, 22, 25 and 28 months of age in laboratory sessions on several tasks pertaining to different dimensions of emotionality such as empathy, guilt, pride, shame as well as embarrassment in addition to measures of self-development such as self-recognition, complexity in pretend play. We now turn to a brief summary of the assessments as well as the behavioral coding on measures used for this report.

Self recognition. Children were assessed in the rouge task repeatedly until they showed clear indications of mark-directed behavior between 19 to 28 months of age. We scored clear mark-directed behavior as the criteria for acquisition of self-recognition.

Complexity in pretend play. Children were also assessed in imitative pretend play tasks (Brownell & Carriger, 1990) between 19 to 28 months of age. Following a 10-15 minute warm up with the props, the experimenter (E) told five stories each of which depicted a progressively more complex form of pretend play using a different theme such as a doctor or a feeding story. Using the feeding theme as an example, the five levels of complex forms of pretend play are as follows: in the first level the E pretends to feed herself from an empty cup; in the second level, the E pretends to feed a doll (the doll is an inactive agent); in the third level, the E displays a story where the doll pretends to feed herself (the doll is an active agent); in the fourth level, the doll feeds a frog; in the fifth level, the doll feeds herself and makes reference to internal states such as being full or hungry. The children were assessed repeatedly on these tasks until they showed correct imitative play at a given level. These tasks are designed to assess the degree of complexity in pretend play, and are thought to reflect complexity in self-other distinction. For

example correct performance at level three shows first evidence of "other" in imitative pretend in play. We scored highest level performance at each age, e.g. a score of 3 means the child showed evidence of "other" in imitative play but did not show an "other" interacting with a different "other," i.e. the frog. We highest level performance at each age as a measure of complexity in pretend play in continuous variable analyses. In categorical analyses, we considered children who at least scored a 3 on this scale to have shown evidence of "other" in their imitative play.

Pronoun Production. The mothers were asked to complete the Mac Arthur Communicative Development Inventory at 18 and 24 months of age. For this report, we considered only the answers relevant to pronoun production such as me, mine, yours etc. In continuous variable analyses, we used the number of pronouns produced, and in categorical variable analyses we required children to produce at least one pronoun.

Embarrassment. The children were observed in two naturalistic contexts designed to elicit embarrassment in previous research (Lewis et al., 1989). In one context, the mother is asked to cajole her child to show the familiar female experimenter what a good dancer s/he is. In the second context, the familiar female experimenter (E) over-compliments the child while taking their pictures. All compliments referred to children's physical/ external attributes, e.g. outfit, rather than internal attributes e.g. smart. Both of these contexts have been shown to elicit embarrassment in previous research. For this report, we used only data collected in the over-complimenting context. Embarrassment Coding. Several discrete behaviors that included self-touch, gaze avert, lip bites/ tongue protrusions, coy smiles, fidgeting, head bends, vocalizations, points (e.g. elaborating on attributes such as pointing out additional attributes), hiding (covering face, whole body turns away from the E) behaviors were coded every 5 seconds up to a maximum of 40 seconds from the time the E delivered each compliment, for a total of three compliments. In addition, we designed a global embarrassment scale (1 to 5) to capture global organizational qualities of children's reactions to each compliment. In categorical analyses, we considered children who received a score of 4 at least once to one of three compliments to have shown embarrassment, i.e. results were not altered when the criteria was changed to a score of 3.

Table 1. Longitudinal and cross-sectional interrelations among categorical measures of three indicators of self-development.

Dependent Variable	Predictor	Method	R^2	p-value
"Other" in pretend play @ 19-mos	Pronoun production @ 18-mos	logistic regression	.01	.09
Pronoun production @ 24-mos	Self-recognition @ 19-mos	linear regression	.17	.01
"Other" in pretend play @ 19-mos	Self-recognition @ 19-mos	logistic regression	.01	.09

Conclusion.

The findings presented in Table 1 are the only significant associations among all possible longitudinal and cross-sectional interrelations that could be examined among the measures (a total of 3 out of 16 possible tests that could be conducted). Thus, we can conclude that self-recognition, pronoun production and complexity in imitative pretend play are largely independent dimensions of a developing sense of self with the exception of those noted in Table 1. A more detailed examination of the significant findings shown in Table 1 reveals that children who were reported to produce pronouns at 18 months were more likely to show a sense of "other" in their imitative pretend play at 19 months of age. In addition, children who showed self-referential behaviors in the mirror-rouge task at 19 months were producing relatively more pronouns at 24 months of age compared to children who did not show mark-directed behavior at 19 months. Finally, a sense of "other" in imitative pretend play appeared to be developmentally easier relative to self-referential behaviors in the mirror rouge task at 19 months of age. For example, while only 29% of children who failed to show mark-directed behavior showed a sense of "other" in their pretend play, 53% of children who showed mark-directed behavior also showed a sense of "other" in their pretend play.

Table 2. Categorical cross-sectional associations between embarrassment and indicators of self-development at each age.

Predictors of embarrassment @ each age	Chi-square (df=1)	p-value
@ 19 months		
Self recognition[a]	27	ns
"other" in pretend play[b]	01	ns
@ 22 months		
Self recognition	69	ns
"other" in pretend play	69	ns
@ 25 months		
Self recognition	22	ns
"other" in pretend play	1.05	ns
@ 28 months		
Self recognition	2.26	ns
"other" in pretend play	01	ns

[a] N = 63 @ 19 months, N= 59 @ 22 months, N = 54 @ 25 months, N = 50 @ 28 months.

[b] N = 64 @ 19 months, N= 59 @ 22 months, N = 60 @ 25 months, N = 51 @ 28 months.

Conclusion:

The 2X2 chi-square analyses fail to replicate the association reported by Lewis et al (1989) between self-recognition and embarrassment. In that study majority of children who showed embarrassment also showed clear mark-directed behavior. Though not significant, our data shows support for the opposite case. For example at 19 months, 15 out of 19 children who were embarrassed (either a 4 or a 5 on the global embarrassment scale) did not show clear mark-directed behavior, and only 4 out of 19 who were embarrassed showed clear mark-directed behavior. When we altered the criteria for embarrassment so that children who received at least a

score of 3 or higher on the global embarrassment scale were considered embarrassed, chi-square independence test was significant at 19 months, $p < .05$ (but not at any other age). However, the cell percentages in the latter analysis showed that embarrassment reactions were more likely among children who did not show mark-directed behavior. For example, 31 out of 37 who were embarrassed did not show clear mark-directed behavior, and only a minority of those who were embarrassed, 6 out of 37, showed mark-directed behavior.

We also explored the possibility that our findings may reflect true "null" findings in the identical twin subsample, since identical twins are significantly more delayed in the acquisition of self-recognition _ due to their physical similarity _. However, when we examined the associations for fraternal and identical twins separately, the results above were not altered. Emergence of "other" in pretend play was also not related to embarrassment using either the criteria of 3 or 4 on the continuous scale.

Table 3. Longitudinal associations between embarrassment and indicators of self development using categorical variables (2X2 chi-square analyses of independence)

Predictor	Embarrassed @ 22 mos	Embarrassed either @ 19 and/ or 22 mos
Self recognition @ 19 mos	ns	ns
"other" in pretend play@ 19mos	ns	ns
Pronoun production @ 18 mos	.02	ns

Predictor	Embarrassed @ 25 mos	Embarrassed either @ 19, 22 and/ or 25 mos
Self recognition		
@ 19 mos	ns	ns
@ 22 mos	ns	ns
@ 25 mos	ns	ns
"other" in pretend play		
@ 19 mos	.07	.09
@ 22 mos	ns	ns
@ 25 mos	ns	ns
Pronoun production		
@ 18 mos	ns	ns
@ 24mos	.02	.01

Predictor	Embarrassed @ 28 mos	Embarrassed either @ 19, 22, 25 and/ or 28 mos
Self recognition		
@ 19 mos	ns	ns
@ 22 mos	ns	ns
@ 25 mos	ns	ns
@ 28 mos	ns	ns
"other" in pretend play		
@ 19 mos	ns	ns
@ 22 mos	ns	ns
@ 25 mos	ns	ns
@ 28 mos	ns	ns
Pronoun production		
@ 18 mos	ns	ns
@ 24 mos	ns	.09

Conclusions:

The series of chi-square independence analyses presented in Table 3 do not provide support for the hypothesis that acquisition of self-recognition is an important determinant of embarrassment reactions in situations involving self-exposure. There appears to be two marginally significant associations between emergence of "other" in pretend play at 19 months and embarrassment at 25months. However, a close examination of the cell percentages reveal that only 7 of 31 children who showed embarrassment at 25 months had also shown a sense of "other" in imitative play. In other words, the results were in the opposite direction.

On the other hand, when we examine the associations between pronoun production and embarrassment reactions the direction of associations was mixed. For example, 13 out of 16 children who were embarrassed at 22 months were not producing any pronouns at 18 months and the majority, 16 out of 19, who were producing at least one pronoun at 18 months did not show embarrassment at 22 months. These percentages do not support developmental priority of pronoun production over embarrassment. In contrast, majority of children who produced at least one pronoun by 24 months, 17 out of 23, showed embarrassment at 25 months consistent with developmental priority of pronoun production over embarrassment. However, 41%, 11 out of 27, who were not producing any pronouns by 24 months were also showing embarrassment at 25 months. Thus, although the latter association was in the predicted direction, there are quite a few children who get embarrassed but do not yet produce any pronouns.

Longitudinal and cross-sectional analyses with continuous variables

Given the lack of replication and at best mixed results between indicators of self-development and embarrassment reactions both cross-sectionally and longitudinally, we carried out additional tests exploring the relations between self-development and continuous measures of embarrassment. Several cautionary remarks are in order regarding the results presented in Table 4. First, the associations presented in Table 4 are the only significant ones out of several nonsignificant associations, thus they could be easily attributed to chance. However, they are informative in that taken together with analyses presented up to this point, they show the complex state affairs that is likely to explain both the lack of replication and mixed findings from this study. Second, embarrassment reactions like other self-conscious emotions require a combination of several discrete behaviors to be displayed. For example, coy smiles alone are not sufficient to infer embarrassment. We coded several discrete behaviors like nervous fidgeting, lip bites, coy smiles, self-touches, gaze averts, hiding, head bends among other behaviors. Behaviors such as hiding and head bends can be considered functionally equivalent with gaze averts used in previous research. Thus, any single association between measures of self development and a discrete behavior is not sufficient to demonstrate a relation between self-development and embarrassment. On the other hand, associations between measures of self-development and the global embarrassment scale allow clear cut interpretations in terms of the support or lack of support for the hypotheses under consideration.

Table 4 Significant cross-sectional & longitudinal associations between embarrassment and indicators of self-development using continuous measures

Predictor	Criterion (indicators of embarrassment)	Association	Predicted Direction?
Self-recognition[a]			
@ 19 mos	(1) global embarrassment @ 22 mos	F(1,50) = 5.72*	Yes
	(2) coy smiles @ 22 mos	F(1,46) = 5.47*	No
	(3) coy smiles @ 28 mos	F(1,37) = 3.79'	Yes
@ 22 mos	(1) global embarrassment @ 28 mos	F(1,39) = 2.93'	No
@ 25 mos	(1) coy smiles @ 25 mos	F(1,40) = 7.31**	Yes
	(2) global embarrassment @ 28 mos	F(1,40) = 4.29*	Yes
complexity in pretend play			
@ 19 mos	(1) gaze avert @ 22 mos	r(53) = .30*	Yes
	(2) global embarrassment @ 25 mos	r(50) = -.27'	No
	(3) self-touch @ 25 mos	r(49) = .27'	Yes
	(4) lip bites @ 28 mos	r(39) = .27'	Yes
@ 22 mos	(1) nervous fidgeting @ 22mos	r (57) = .30*	Yes
	(2) head bends @ 22 mos	r(57) = .22'	Yes
	(3) lip bites @ 28 mos	r(42) = .32*	Yes
@ 28 mos	(1) coy smiles @ 28mos	r (47) = .46**	Yes
	(2) lip bites @ 28 mos	r(47) = .27'	Yes

Pronoun production			
@ 18 mos	(1) hiding @ 19 mos	r(36) = .31*	Yes
	(2) global embarrassment @ 19 mos	r(48) = .32*	Yes
	(3) global embarrassment @ 22 mos	r(44) = -.29*	No
	(4) head bends @ 25 mos	r(45) = .31*	Yes
	(5) self-touch @ 28 mos	r(35) = .33*	Yes
@ 24 mos	(1) head bends @ 25 mos	r(43) = .27*	Yes

* Because self-recognition is a truly dichotomous measure, one-way between subject ANOVAs were carried out, thus instead of pearson correlations the associated F-values are presented; the predicted direction column in this case refer to mean differences for children who showed clear mark-directed behavior versus those who did not.

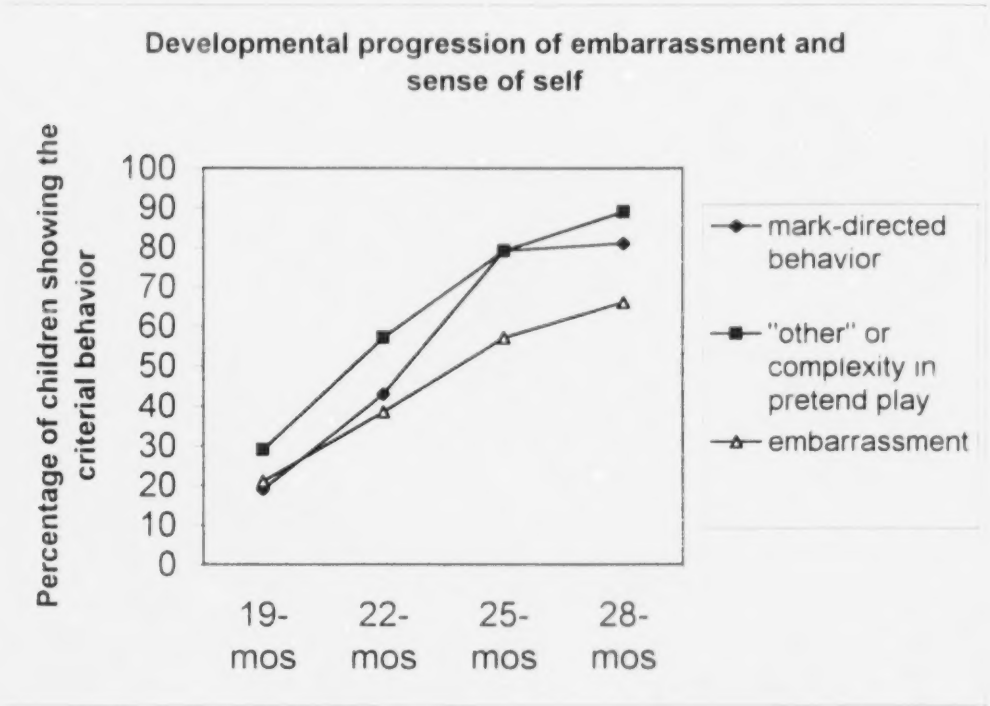
Conclusion:

The analyses with continuous variables show that overall complexity in pretend is associated with several discrete behaviors that are consistent with embarrassment reactions like lip bites, fidgeting, coy smiles, self-touches and gaze averts (i.e. head bends, hiding can be considered functionally equivalent with gaze averts) but these associations are dispersed in the age range studied. The only association that would be clearly supportive of the hypothesis, the correlations between complexity in pretend play and global embarrassment scale is in the opposite direction consistent with the findings presented in Table 2. Continuous measures of pronoun production at 18 months are also negatively correlated with global embarrassment at 22 months, inconsistent with predictions, but positively correlated with the same measure at 19 months consistent with predictions.

Mean differences on both the discrete behaviors and global embarrassment measure given mark-directed behaviors show both consistent and inconsistent associations. For example, while children who engage in clear mark directed behavior by 22 months receive lower means on the global embarrassment scale at 28 months, children who engage in clear mark-directed behavior by 25 months receive higher means on the embarrassment scale at 28 months.

These at best mixed but largely unsupportive findings for the developmental priority of self development over embarrassment suggest that development in these domains follow a parallel course between 19 and 28 months of age, i e. no interaction. In order to examine support for the parallelism hypothesis we examined the percentage of children who reached the criterial performance on self recognition, emergence of "other" in imitative pretend play and embarrassment from 19 to 28 months of age. Figure 1 presents the results descriptively.

Figure 1. Percentage of children reaching the criteria on self-recognition, self-other distinction in imitative pretend play and embarrassment.



Conclusion:

Figure 1 shows the pattern of development in all three domains, self-recognition, complexity in pretend play and embarrassment that were measured from 19 to 28 months of age. The figure illustrates three important points about development in this age range. First, development in three domains is overall parallel. Secondly, there appears to be differences in the rate of change most notably between the embarrassment curve and self-recognition and pretend play curves, where the former is slower relative to the rate of change in self-recognition and pretend play curves. Finally, there appear to be no differences in the initial level/ intercepts between recognition and embarrassment curves, while there may be some differences on this parameter between the pretend play curve and the remaining two curves.

These observations were confirmed when we fitted polynomial growth curves to each child's data, and then compared the average rate of change (across children) as well as intercept for embarrassment, self-recognition and complexity in pretend play. A one-way within-subject ANOVA did not show any significant differences among the average intercepts for the three processes, however the rates of change were significantly different, $p < .001$ with $n = 30$.

CONCLUSIONS

Our findings provide very limited support to the hypothesis that the acquisition of a distinct sense of self is associated with embarrassment reactions as they were assessed in this study. Rather the findings strongly suggest that development in these three domains, complexity in pretend play, self-recognition and embarrassment run largely parallel to each other with different rates of change. Relations between pronoun production and embarrassment were mostly mixed, some associations supported and some contradicted the developmental priority of pronoun production as a measure of self-development over embarrassment.

The latter set of analyses concentrating growth parameters suggest that small sampling fluctuations can give rise to percentages that are consistent with an interaction effect reported by Lewis et al. (1989) between self-recognition and embarrassment with a cross-sectional sample either at 19 or 22 months of age. It is in this age range that the curves for embarrassment and self-recognition touch each other (an interaction effect). It is unlikely that the lack of replication could be attributed to the small sample sizes in our study since the sample size was more than twice the size of Lewis et al's sample. Our findings do suggest that if the hypothesized relations between embarrassment and measures of self-development such as pronoun production, self-recognition and complexity in pretend play, are true, the effect sizes are likely to be small. Thus, our findings strongly suggest that future studies should use larger sample sizes in the context of longitudinal data between 18 to 25 months of age with shorter time intervals between assessments.

These findings also suggest that conceptual work needs to better delineate the relationships between the emergence of complex emotions like embarrassment and the development of a sense of self. For example, complexity in imitative pretend play measures what children are capable of, but not necessarily how children transfer such capacities into their spontaneous pretend play. Similarly, our measures of pronoun production did not capture how frequently children actually produce such pronouns in everyday contexts involving social

interactions with others. These findings strongly suggest that the questions surrounding the emergence of complex emotions like embarrassment and its relation to development of a sense of self distinct from others is a conceptually challenging area that call for further study.